

R E P O R T R E S U M E S

ED 018 860

EA 001 236

OUTLINE OF AN URBAN EDUCATIONAL MODEL.

BY- O'BRIEN, RICHARD J. LYLE, JEROLYN R.

NATIONAL CENTER FOR EDUCATIONAL STATISTICS (DHEW)

REPORT NUMBER TN-57

PUB DATE 22 JAN 68

EDRS PRICE MF-\$0.25 HC-\$0.76 17P.

DESCRIPTORS- *URBAN SCHOOLS, EDUCATIONAL PLANNING, EDUCATIONAL PARKS, EDUCATIONAL POLICY, SECONDARY SCHOOLS, ELEMENTARY SCHOOLS, *STUDENT ENROLLMENT, *SCHOOL LOCATION, METHODOLOGY- STUDENT TRANSPORTATION, *EDUCATIONAL FACILITIES, INSTRUCTIONAL STAFF, COSTS, COST EFFECTIVENESS, *DECISION MAKING, *SCHOOL SIZE, DISTRICT OF COLUMBIA, URBAN EDUC. MODEL,

THIS TECHNICAL NOTE IS A NONTECHNICAL DISCUSSION OF THE URBAN EDUCATION MODEL, AN ANALYTIC, SYMOBLC MODEL TO BE USED IN PLANNING THE LOCATION AND ENROLLMENT SIZE OF URBAN SCHOOLS. AMONG THE EDUCATIONAL ALTERNATIVES THAT MAY BE CONSIDERED BY THE METHODOLOGY PRESENTED ARE THE "GREAT HIGH SCHOOLS" AND THE "EDUCATIONAL PARKS." THE CENTRAL ORIENTATION OF THE URBAN EDUCATIONAL MODEL IS PLANNING THE LOCATION AND ENROLLMENT SIZE OF ELEMENTARY AND SECONDARY SCHOOL PLANTS. FOUR SUB-MODELS COMPOSE THE GENERAL URBAN EDUCATION MODEL. THE URBAN SUB-MODEL DETERMINES ATTENDANCE AREA BOUNDARIES BY ASSIGNING PUPILS TO SCHOOLS SO AS TO ACHIEVE GIVEN OBJECTIVES. THE SCHOOL SUB-MODEL ESTIMATES SPACE AND STAFF REQUIREMENTS PER SCHOOL. THE COST SUB-MODEL ESTIMATES THE COST IMPLICATIONS OF ATTENDANCE AREA BOUNDARIES AND SPACE-STAFF REQUIREMENTS. THE EFFECTIVENESS SUB-MODEL ASSURES THAT A PREDICTION OF ACHIEVEMENT LEVELS ON AN AGGREGATED SCHOOL PLANT BASIS MAY BE MADE BASED ON THE VARIABLES DEFINED IN OTHER SUB-MODELS, THAT IS STUDENT SOCIOECONOMIC AND SCHOOL VARIABLES. THE MODEL DOES NOT YIELD A "SOLUTION" BUT DOES PROVIDE AN ARRAY OF MEASURES OF POTENTIAL USE TO THE SCHOOL ADMINISTRATOR. EA 001 235 IS A RELATED DOCUMENT. (HW)

ED018860

Working Paper
Does Not Reflect
Official Policy of
The Office of Education

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE
PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS
STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION
POSITION OR POLICY.

NATIONAL CENTER FOR EDUCATIONAL STATISTICS
Division of Operations Analysis

OUTLINE OF AN URBAN EDUCATIONAL MODEL

by

Richard J. O'Brien
Jerolyn R. Lyle

TECHNICAL NOTE
NUMBER 57

January 22, 1968

OFFICE OF EDUCATION/U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

EA 001 236

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
John W. Gardner, Secretary

OFFICE OF EDUCATION
Harold Howe II, Commissioner

NATIONAL CENTER FOR EDUCATIONAL STATISTICS
Francis C. Nassetta, Acting Assistant Commissioner

DIVISION OF OPERATIONS ANALYSIS
David S. Stoller, Director

OUTLINE OF AN URBAN EDUCATIONAL MODEL

Planning School Plants

It is generally accepted today that educational policy as exercised by urban school administrators is inextricably linked with the aspirations of the city as a whole. The school administrator is required to plan facilities and programs that promote general city-wide social, racial and economic progress as well as educational progress. In response to this, urban school administrators plan for the replacement of outdated and ill-equipped school plants in order to achieve the stature for new center city schools that will attract the middle class families of the suburbs. Stated goals of the new schools have been "viable racial balance" and "varied economic composition." A recent survey by the Center for Urban Education (New York) indicated that 85 out of 457 cities were either building or planning to build large educational complexes containing the latest in modern and special facilities.

It is evident that for a meaningful evaluation of alternatives, in the scope of the "Great High Schools" and "Educational Parks," a methodology for the systematic definition and evaluation of alternatives is needed. A truism as reported by the Educational Facilities Laboratory is, "no longer can schools be located by spot map, putting schools wherever the dots (children) are clustered." The Urban Education Model is a step in the direction of the planning methodology that is now required by the city school administrators, a methodology for the systematic statement and evaluation of alternatives.

Model Process

The central orientation of the Urban Education Model is planning the location and enrollment size of elementary and secondary school plants. Four Sub-models compose the general Urban Education Model. Though each is useful alone, the solution of one Sub-model provides outputs which become inputs for the solution of another. The sequence of computations outlined below is productive of maximum analytic pay-off.

The Urban Sub-model determines attendance area boundaries by assigning pupils to schools so as to achieve one of three objectives:

- to minimize the money costs of transporting pupils to and from school
- to minimize the time pupils spend in traveling to and from school
- to minimize the distance pupils go in traveling to and from school

The objective chosen is achieved so as to satisfy certain constraints which educators may wish to place on the composition of the student body in each school. These constraints assume that some desired combination of age, race, and social class exists. A model user may compare, for example, the attendance area boundaries minimizing student transportation costs for schools with no less than a thirty percent racial minority to the boundaries achieving the same transport objective with no less than a forty percent racial minority. Model users must have these data in order to determine such attendance areas:

- Student population, by age, race, and social class
- Location of existing and planned school plants
- Money costs, or time spent, or distance for transportation of the student population

Having determined which students will attend which schools, educators may estimate space and staff requirements per school using the School Sub-model. This Sub-model enables educators to estimate total space and total staff needed for a given student body and to see how these requirements vary as:

- Staff utilization patterns vary
- Programs and curricula vary
- Space utilization patterns vary

Users of this Sub-model need these data:

- Total student population for given schools
- Staff-student ratios for planned levels of staff utilization and program content
- Space per student required for planned curricula and programs

Of importance to planners of educational facilities are the cost implications of attendance area boundaries and space-staff requirements. The Cost Sub-model uses data from the other Sub-models to estimate these implications. The estimates include:

- Construction and renovation of school plant costs
- Costs of acquiring land
- Initial and operating costs of bus transportation for students
- Special equipment costs

- Staff costs and other current operating costs
- Costs of capital financing

The general character of this cost format enables the application of this Sub-model to districts whose cost accounting procedures vary greatly. Data requirements do not necessitate massive bookkeeping changes by Model users. Data needs include, for example:

- Total salary expenditures for a given year and for a given school
- Total number of employees of the school under analysis for given year
- Number of students desiring bus transportation
- Capacity of buses owned by the district used for a given school
- Distance travelled by buses transporting students to and from the school

A desirable feature of the Cost Sub-model is that it has six distinctly separate cost components. A user might use only those components for which he has data. This exemplifies the flexibility which users will find in the entire Urban Education Model. It is designed to meet many or few analytic needs and to utilize available data. It is hoped that it will be operational up to the level of data availability of any local school district in which planning needs are felt.

The Effectiveness Sub-Model is essentially a "plug-in" model. It assumes that a prediction of achievement levels on an aggregated school plant basis may be made based on the variables defined in the other Sub-models, that is student socioeconomic and school variables. That this can be done with sufficient precision has been amply demonstrated

by several major studies including the Office of Education's Equal Opportunity Survey.

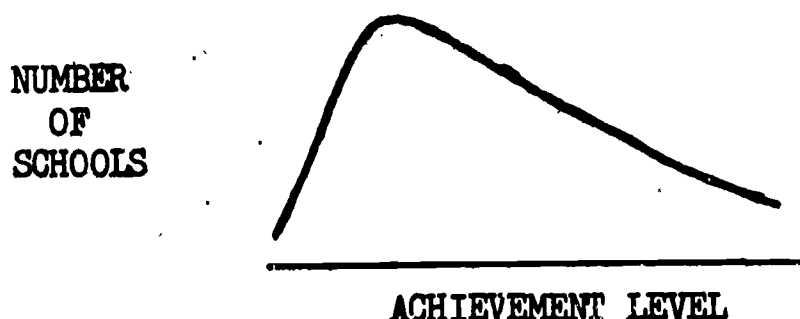
To employ this aspect of the model it is necessary to have individual student achievement data, and the corresponding family and school data associated with the individual student. Once these data are available, standard computerized multiple regression techniques may be employed to yield estimates of school achievement levels.

Evaluation of Alternatives

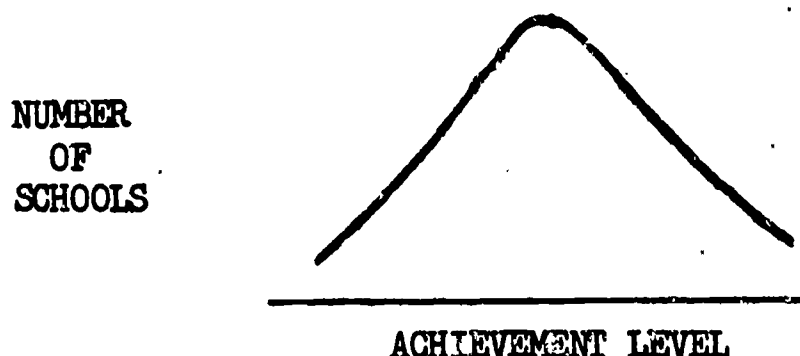
Many outputs are generated by the above process. These are generated for each alternative policy specified by the educational decision maker. One alternative might specify a given location, another a particular grade grouping, another a particular enrollment size for the new school plant, another a particular racial balance and so forth. The set of data produced by the model process are summarized in the following table:

<u>Measure</u>	<u>Schools</u>	
	<u>Elementary</u>	<u>Secondary</u>
1. Predicted Achievement Level	$\bar{x}_1 \bar{x}_2 \dots \bar{x}_n$	$\bar{x}_{n+1} \dots \bar{x}_m$
2. Racial Composition	$R_1 R_2 \dots R_n$	$R_{n+1} \dots R_m$
3. Social Composition		
4. Distance Metric		
(a) Average	.	.
(b) Maximum	.	.
(c) Minimum	.	.
5. Cost		
(a) Initial		
(1) Buildings		
(2) Equipment		
(b) Current		
(1) Salaries		
(2) Other		
(c) Cost per pupil	$\bar{c}_1 \bar{c}_2 \dots \bar{c}_n$	$\bar{c}_{n+1} \dots \bar{c}_m$

It is difficult to use several output measures as a basis for making a decision. In the face of incommensurate data however there are few alternatives. One way of looking at the data which may be helpful in interpreting and summarizing the data is the following. Consider for example the distribution of each measure over the various schools. The distribution of predicted achievement levels may look like the following,



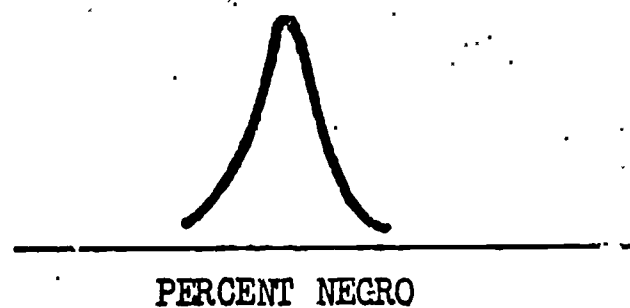
The corresponding distribution on a national scale may look like



One way to measure the disparity between the predicted and national distributions is in percentiles relative to the national norm, such as, 80 percent of the schools are predicted to be below the national achievement norms.

A similar approach may be made with other output measures. In some cases the norm may be more obvious and readily specified. For example the norm for racial balance may look like,

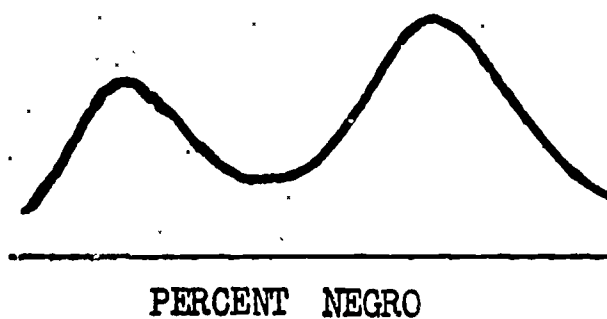
NUMBER
OF
SCHOOLS



i.e., near a constant percentage.

The actual distribution may look like,

NUMBER
OF
SCHOOLS



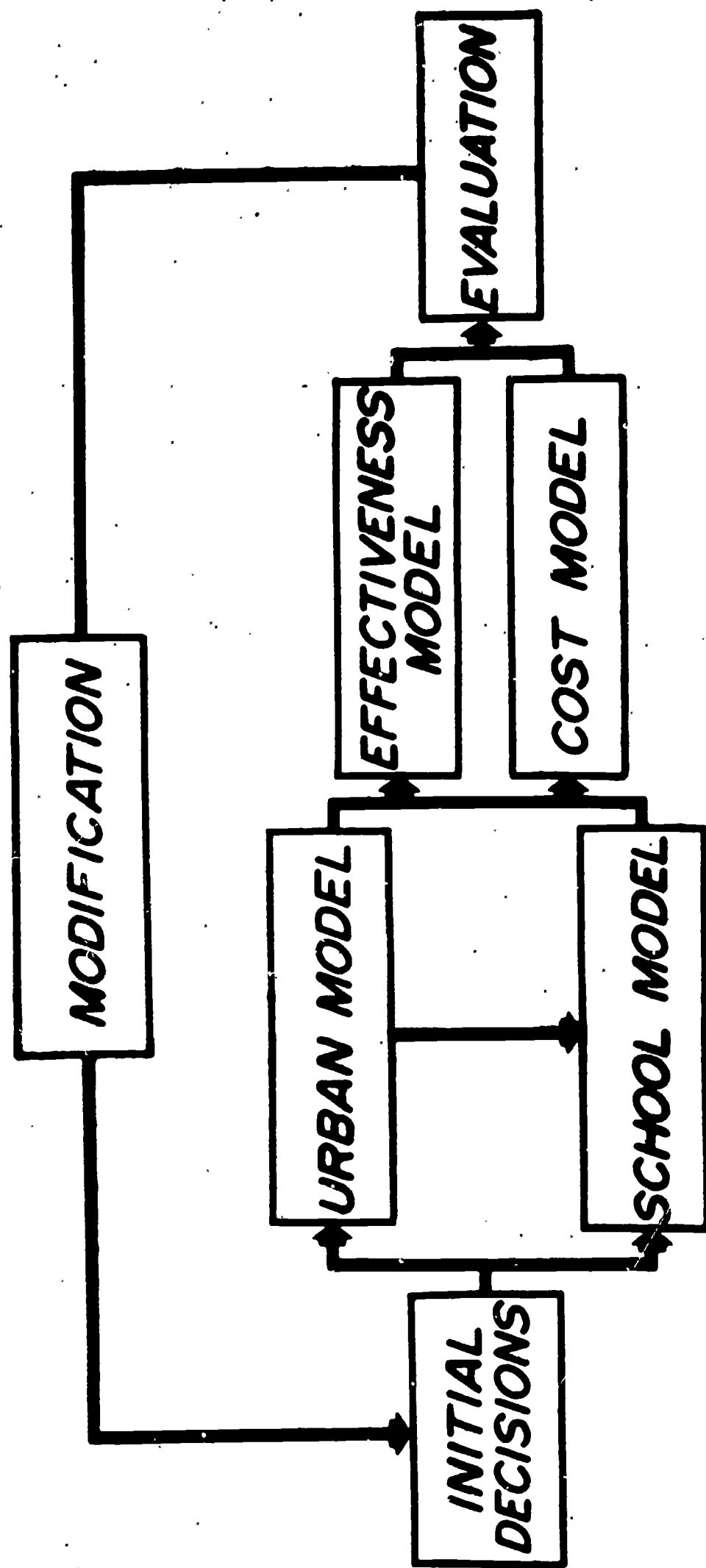
which is the distribution current in many central cities.

In any case the model does not yield a "solution." It provides an array of measures which, hopefully, is meaningful to the school administrator and upon which a decision may be based. It is hoped that, in narrowing the area in which intuition is the only guide, better decisions may be made in the long run.

REFERENCES

1. TN-24 - Urban Education System Analysis, Stephen C. Clark, Richard J. O'Brien, and C. Marston Case, January 20, 1967, U. S. Office of Education
2. TN-30 - Cost Model For Large Urban Schools, Richard J. O'Brien, April 26, 1967, U.S. Office of Education
3. TN-38 - School Submodel For Large Urban Schools, Richard J. O'Brien, June 21, 1967, U.S. Office of Education
4. OE-38001 Equality of Educational Opportunity, 1966, Department of Health, Education, and Welfare, James S. Coleman, et. al.
5. Input and Output in Large-City High Schools, Jesse Burkhead, Thomas G. Fox and John W. Holland, 1967, Syracuse University Press
6. Research on Achievement Determinants in Educational Systems, Jerolyn R. Lyle, paper being prepared for publication, U. S. Office of Education
7. Racial Isolation in the Public Schools (Appendices), 1967, U. S. Commission on Civil Rights
8. Mathematical Analysis Applied to School Attendance Areas, Ernest Koenigsberg, Matson Research Corporation, paper presented at the U.S. Office of Education Symposium: Operations Analysis of Education, November 1967, Washington, D. C.

SYSTEM OVERVIEW



URBAN MODEL

INPUT

1. SCHOOL PLANTS
LOCATION
CAPACITY
LEVEL
2. STUDENTS
AGE
RACIAL
SOCIAL
LOCATION
3. SCHOOL PLANT
RACIAL AND
SOCIAL RANGES

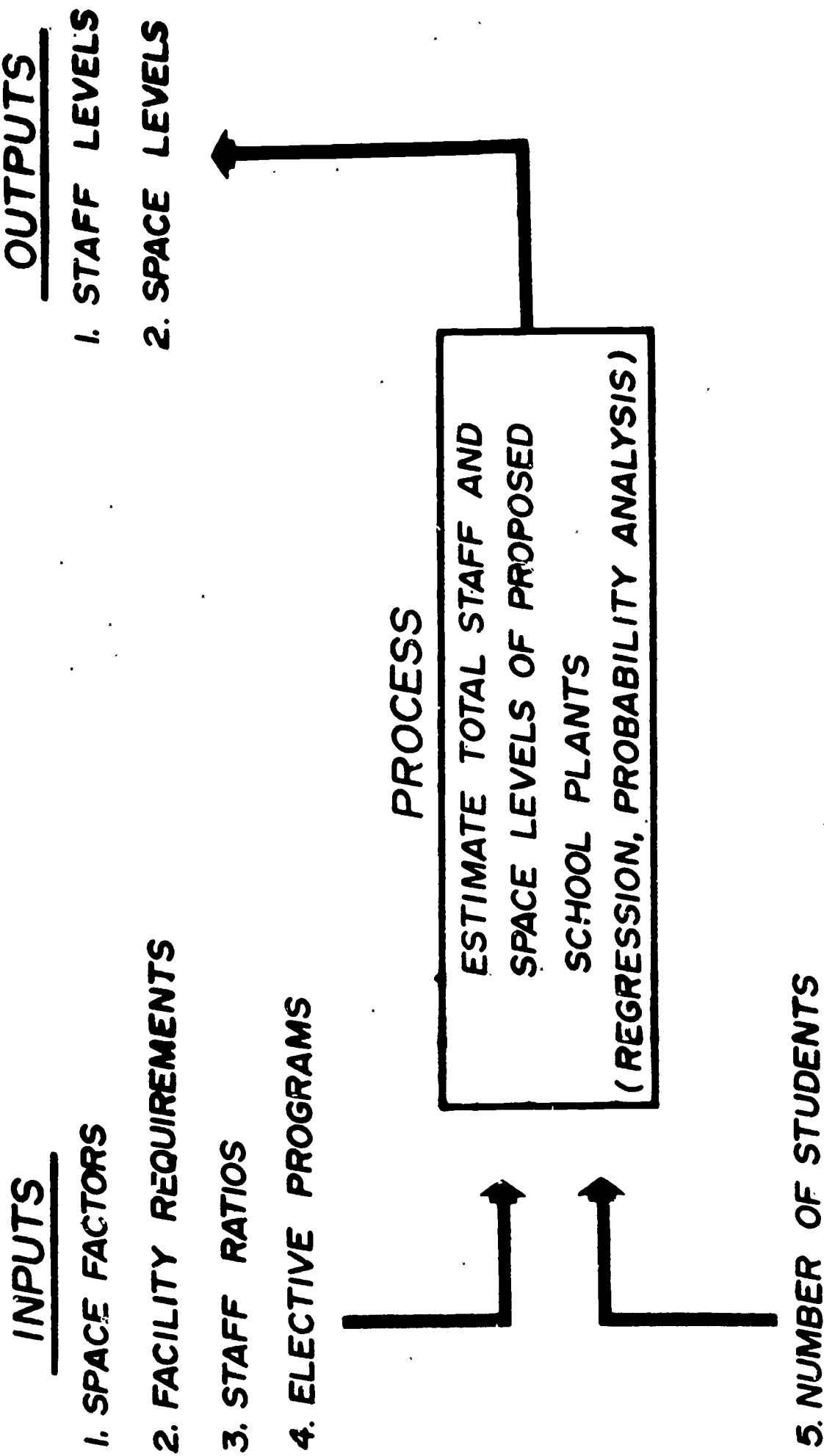
OUTPUT

1. ASSIGNMENT OF STUDENTS
TO SCHOOLS
2. ENROLLMENTS AT EACH
SCHOOL PLANT
3. ACHIEVED LEVELS OF RACIAL
AND SOCIAL BALANCE
4. STUDENT DISTANCE MEASURES

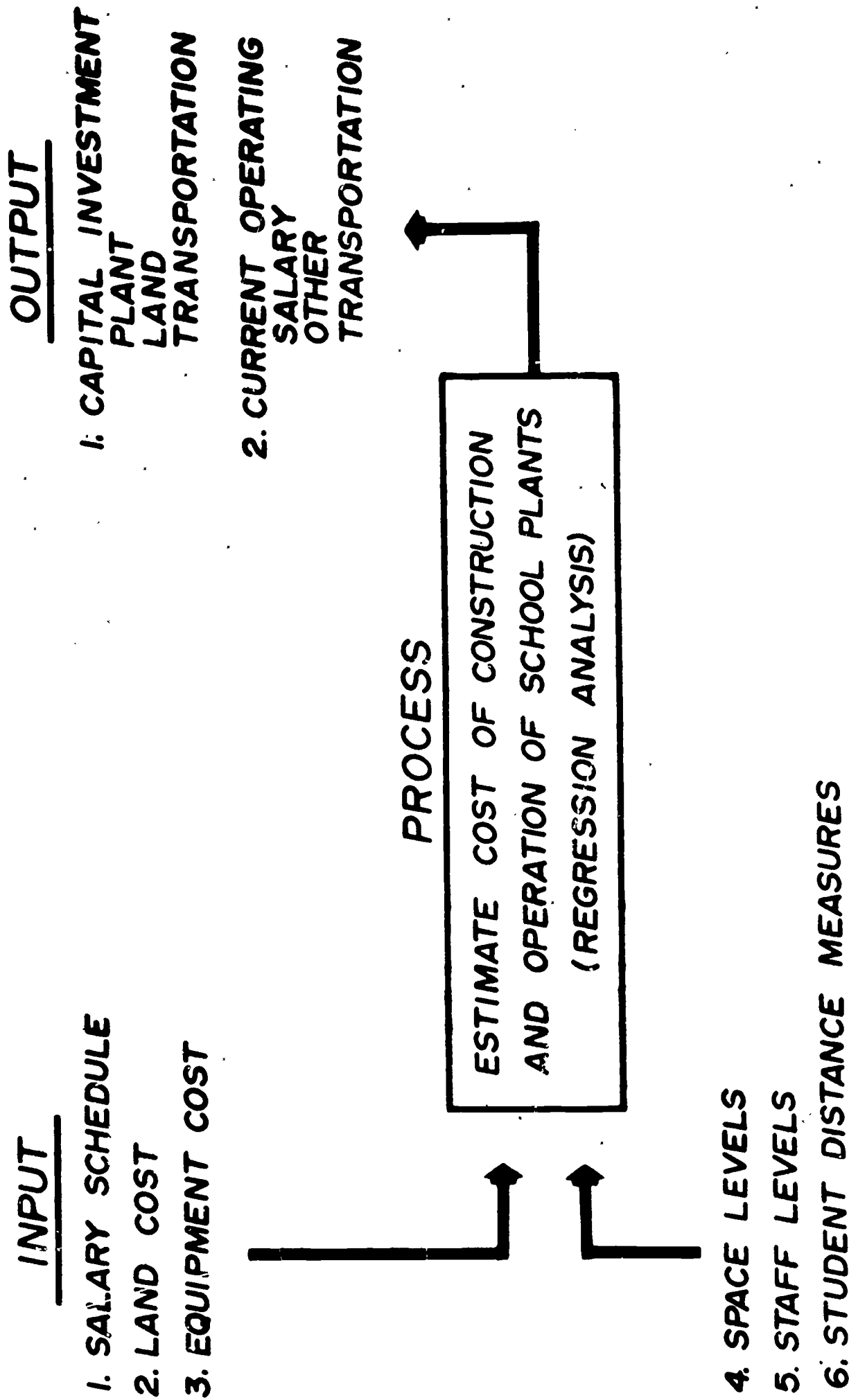
PROCESS

ASSIGNMENT BASED ON
PRESELECTED CLOSE-
NESS MEASURE
(LINEAR PROGRAMMING)

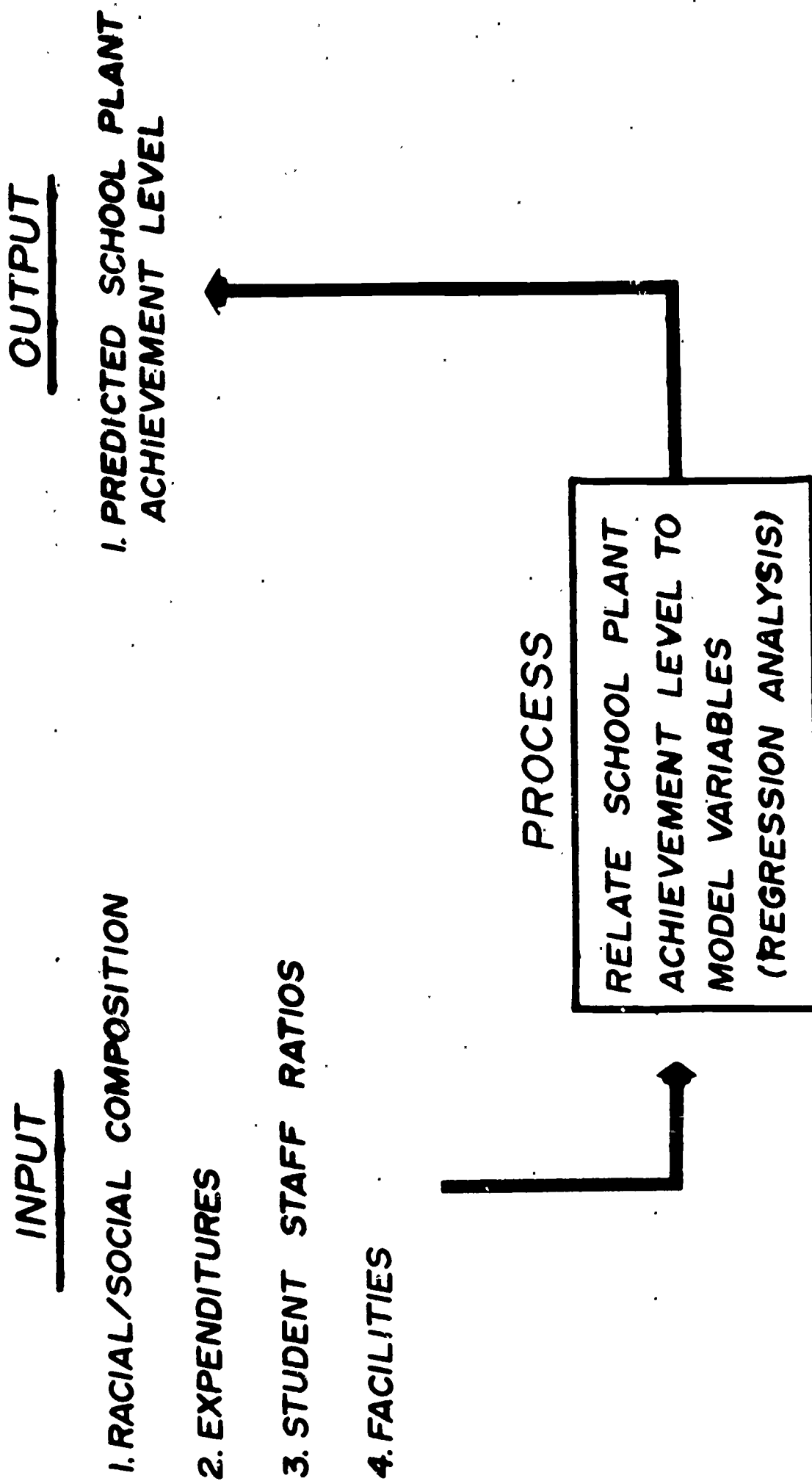
SCHOOL MODEL



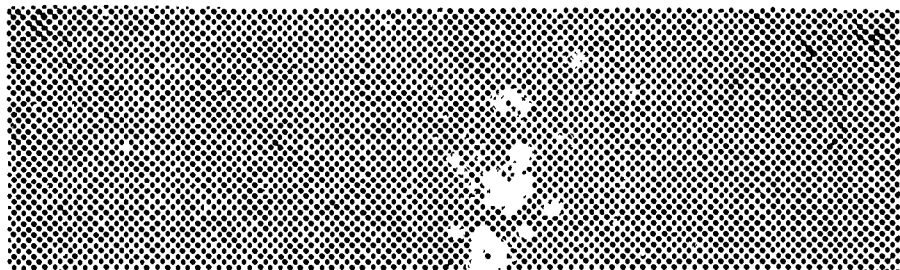
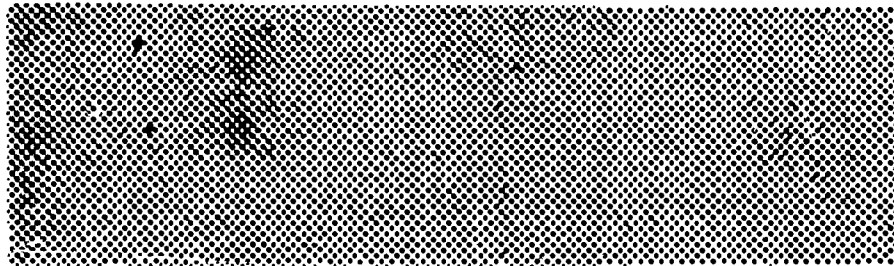

COST MODEL



EFFECTIVENESS MODEL



EVALUATION

MEASURE	ALTERNATIVE PLANS		
	I	II	III
1. PREDICTED ACHIEVEMENT LEVEL			
2. RACIAL BALANCE			
3. SOCIAL BALANCE			
4. ENROLLMENT SIZE			
5. STUDENT TRAVEL DATA			
6. COST DATA			
7. STAFF LEVELS			
8. MAJOR FACILITIES			